[Coat of Arms] European Patent Office

(11) Publication No. **0 178 504**
A1

(12) **EUROPEAN PATENT APPLICATION**

(21) Application No.: 85112148.3

(22) Date of filing: 25 September 1985

(51) Int. Cl.[4]: **E 04 B 2/74**
E 05 D 1/00

(30) Priority: 19 October 1984 DE 3438404

(43) Publication date of the application:
23 April 1985, Patent Bulletin 88/17

(84) Named as contracting states:
AT BE CH DE FR IT LI NL

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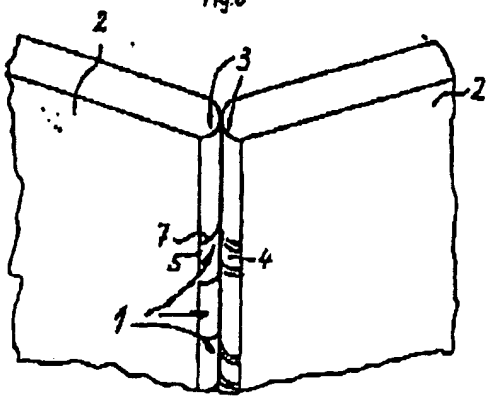
(54) Hinge Joint

(57) A hinge joint (1) for at least two plate elements (2) that are variable relative to one another in their angular positions and can be detached easily from one another, has hinge parts (4 and 6) that are convexly curved at the facing edges. Thus, the two hinge parts (4 and 5) can be rolled one upon another as they are swiveled relative to one another. The holding power between the two hinge parts (4 and 5) is generated in the convex area by magnets (6). Said magnets on the one hand allow the rolling off upon one another and they allow the easy detachment and connection of the plate elements, while still providing the desired holding strength between the two hinge parts in any angular position.

Fig.8



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Hinge Joint

The invention relates to a hinge joint for at least two plate elements that are variable relative to one another in their angular positions, are detachable from one another and at their facing and abutting edges have at least one respective hinge part, at least one of which is of convex curvature in cross-section, with these two said hinge parts being adapted to be rolled one upon another as they are swiveled relative to one another, and with said plate elements preferably having, in addition to the hinge joint, at least one additional holding means.

There are already a number of known hinge joints. A hinge joint for a swivelable plate element, such as a window, a door, or any other plate-shaped element, often has a stud bolt, with an appropriate sleeve that rests on an axial stop being placed over said stud bolt.

In other hinge joints, a hinge stud bolt intersperses elements that are swivelable relative to one another, which then can be rolled one upon another in certain parts.

Also known are hinge solutions for swinging doors, for example, where large swivel angles from a center position in the direction of both sides are feasible.

However, the use of hinge bolts tends to complicate the detaching of the hinge joint and requires an increased effort.

The present invention was based on the problem of creating a hinge joint that will allow arbitrary changes in the angular positions of two plate-shaped elements or plates, while also allowing an easy separation of said elements. The swiveling should be possible without any great expenditure of force, but with the hinge joint still generating sufficient holding strengths.

The solution to this apparently contradictory problem is a magnetic connection between the two hinge parts in the convex area.

This measure on the one hand enables an easy rolling off of the hinge parts upon one another without any great expenditure of force, while nevertheless achieving a safe connection if the magnet(s) are sized appropriately. This, for example, also allows an easy separation of the two parts connected by the hinges if they are required in a different constellation or application. In this way, plate-shaped elements that absorb sound or restrict the view can be arranged arbitrarily in a very simple way, while they can also be fastened safely to one another when in use position.

Although it would be possible to provide another detachable joint between the parts that can be rolled upon one another, the respective ability to roll the parts upon one another and/or detach the plates would be diminished relative to the solution according with the invention. At the same time, it is possible with the help of magnets to create a joint where the parts that

provide said connection strengths are protected and safely positioned against damages, thus ensuring their holding strengths even under unfavorable mechanical influences, and providing them with a long service life.

A particularly favorable hinge joint for such plate elements is achieved if the plate elements, which preferably can be connected across the entire length, have several hinges with at least one magnet distributed across the entire height. In this way, such plate elements can support one another, especially if they also have vertical members with feet, etc.

A preferred embodiment of the hinge joint can be that one of the hinge parts has at least one magnet and the complementary hinge part has a magnetic material at the height of the magnet(s). This solution is particularly economical because the hinge joint then only requires genuine magnets in one hinge part.

The two hinge parts can be formed by metal profiles with convex rounded cross-sections at the facing sides, preferably of a non-magnetic material, especially aluminum, etc., with a magnet being inserted in at least part of one of the hinge parts and an oppositely poled magnet or a part made of magnetic material being positioned at the same height at the other hinge part. This results in a smooth and rugged surface in the contact- and rolling area of the hinge parts.

The magnet is usefully developed as a plate and has on both sides pole shoes arranged in the cross-sectional levels of the edge profile. This results in a good magnetic flow from the magnet plate to the pole shoes and vice versa and allows the generating and/or transmitting of significant magnetic powers in a small area.

In this way, it is advantageous if the pole shoes protrude at the surface of the hinge parts relative to the actual magnets and if at least the upper side of the hinge parts and the pole shoes are preferably coated with plastic or foamed material that ends flush with the protruding pole shoes. This protects the magnet itself and concentrates the magnetic forces at the pole shoes. The plastics surface at the hinge parts facilitates the reciprocal rolling off as well as the detaching of the two hinge parts from one another.

For a simple adaptation of the hinge parts by rolling upon one another, it is especially favorable if the convex curvature of the hinge parts has the shape of a circular arc in cross-section and preferably reaches across approximately a half-circle. It is feasible to adjust appropriately sized angles with the appropriately formed magnets and/or pole shoes transmitting sufficiently great magnetic holding strengths in all of said angular positions to firmly hold the two hinge parts together, and without the rolling off being complicated in any way by mechanical holding means. Sinking the magnets into the edge profiles furthermore rules out that the powers acting on said holding elements during the rolling off or detachment could destroy said magnets or remove them from their seat(s).

For a good transmission of strength and attachment and at the same time an easy rolling off as well as detaching of the hinge joint, it is advantageous if across the height of at least one of the hinge parts that can be rolled off upon one another, two or more magnets are inserted in said hinge part, and a ferromagnetic counterpart is inserted in the complementary hinge part at the same height as the magnets. The magnets inserted in one hinge part, which preferably have the shape or a half-circle in cross-section, are usefully magnetized through such that the field lines run toward the pole shoes. Such magnet arrangements are

particularly advantageous if the magnets act in cooperation with ferromagnetic counterparts.

The hinge joint in accordance with the invention not only allows the connecting of two plate elements, but it is feasible to adapt even three or more plate elements relative to one another in their angular position, with their edges abutting at a common position. In this case, it is useful if magnets are inserted in the curved hinge part of a plate element and counterparts of ferromagnetic material are inserted in the other plate elements. With four or even six plate elements proceeding from a common position, it is also possible to arrange hinge parts with magnets and with ferromagnetic materials abutting alternately.

To form a chain of plate elements or to assign a plurality of plate elements arbitrarily to one another, it is useful if one plate element has at least one hinge part with magnets at one vertical edge and at least one complementary hinge part at the opposite parallel edge. In this way, a plurality of plate elements can be arranged in series, but with their angular positions also being variable. Nevertheless, all plate elements can be developed to complement one another, which simplifies their assignment to one another.

Especially when combining one or more of the aforementioned characteristics and measures, the result is a hinge joint for plate-shaped components that can be connected firmly in arbitrary angular positions, but is nevertheless easily detachable. Said components are used preferably for blocking views and/or noise reduction without having to overcome great holding strengths when adapting the angular positions of the parts, and with the joints between said parts being detachable, but nevertheless of relatively high strengths. Although couplings with the help of magnets are known, these couplings are either developed dynamically if a rotating magnet causes a complementary magnet to

rotate as well, or said couplings are intended for a joint that always remains the same between two parts that then always are in a firm and predetermined position relative to one another, which always remains the same, such as is the case in the closing of a cabinet door, for example. The present invention, however, creates a joint with two parts that can be swiveled relative to one another in their angular position, where the point of adhesion travels during the swiveling and rolling off of said parts and then effects a sufficiently firm joint between said parts in the respective position. In doing so, it is preferred that they are continually adaptable.

In the following, the invention and the details essential to the invention are explained in greater depth by means of an illustration. Said illustration shows, in partially schematized representation:

Fig. 1 A lateral view of a hinge joint in accordance with the invention, with the two hinge parts detached from one another,

Fig. 2 One each front view of a hinge part and a complementary hinge part of the hinge joint in accordance with the invention,

Fig. 3 a top view and/or a cross-section of a hinge joint in accordance with the invention, with the actual plate elements to be connected (not shown) together form an angle of approximately 180° in the shown position

Fig. 4 an embodiment of a hinge joint where a total of six hinge parts cooperate,

Fig. 5 an embodiment of a hinge joint where a total of six hinge parts cooperate for the same number of plate elements,

Fig. 6 a cross-section of a magnet assigned to a hinge part, with a pole shoe protruding relative to said magnet

Fig. 7 a view of the magnet according to Fig. 6 and the two pole shoes, with the arrows indicating that the magnet is magnetized through, as well as

Fig. 8 a diagram and a schematic representation of two plate elements (shown only partially), which are at an angle relative to one another and are connected by the hinge joint in accordance with the invention.

A hinge joint with the general reference symbol 1, is shown primarily in operating position in the figures 3 to 5 and 8 and has the purpose of connecting two plate elements 2 to be adapted on the one hand with respect to their angular position, with said plate elements on the other hand also being detachable from one another without having to remove any screws, bolts or the like.

The plate elements 2, which may be comprised of several layers of noise-absorbing material or the like, have at least one hinge part 4 and/or 5 on the respective facing edges 3, with both hinge parts 4 and 5 having a convex curvature in cross-section in the embodiment, such that they can be rolled off upon one another when swiveled relative to one another.

Figures 1 to 5 show in detail that the two hinge parts 4 and 5 are connected magnetically in the convex area. Fig. 8 shows that the plate elements 2, which can be connected and swiveled relative to one another, can be connected to one another across the entire length and/or height and have, distributed across the

height, a plurality of hinges 1 with at least one respective magnet 6. In that way, there may be at least one magnet 6 at a hinge part 4, and in the embodiment according to Fig. 1 and 2 two magnets 6 and at the corresponding complementary hinge part 5 a magnetic material 7 at the same height as the magnets 6, which according to the figures 1, 2 and 3 may be an appropriately curved steel plate at the surface of edge 3. Fig. 3 furthermore shows that the two hinge parts 4 and 5 may be formed by metal profiles 8 with a convex rounded cross-section facing at the sides, preferably of a non-magnetic material such as aluminum or the like, into which one or a plurality of magnets 6 are inserted at the one hinge part 4 in the appropriate hinge areas, with the part 7 of magnetic material, preferably iron or steel, being located opposite said magnet(s). It is also feasible to arrange an oppositely poled magnet at said location. The figures 6 and 7 show that the magnet 6 is developed respectively as a plate and has on both sides pole shoes 9, which according to figure 1 and 2 are arranged in the cross-section planes of the edge profile 8 and/or the edge 3. In that way, the pole shoes 9 protrude relative to the actual magnets 6 at the surface of the hinge parts 4. Fig. 1, 2 and 8 show that the top of the hinge parts 4 and 5 can be coated with a plastics or foamed material coat 10 that ends flush with the protruding pole shoes 9. Thus, the pole shoes 9 can exert good magnetic strength on the complementary hinge part 5 and the magnetic part 7 provided there. Despite the rolling off of the hinged parts 4 and 5 relative to one another, it is possible to generate especially favorable magnetic holding strengths that act in practically all arbitrary angular positions of the plate elements 2 if the magnets 6, which are inserted in a hinge part 4 and, according to Fig. 6, have the shape of a half-circle in cross-section, are magnetized through according to Fig. 7 and the arrows Pf shown there, such that the field lines run to the pole shoes 9. The convex curvature of the hinge parts 4 and 5 also has the cross-section of a circular arc and reaches approximately across a half-circle.

Thus, very large angular areas of the two plate elements 2, which can be detachably connected to one another, can be adapted arbitrarily.

The figures 3 to 5 show that the edge profiles 8, which are curved outward and/or curved convex or shaped like a circular arc in cross-section relative to one another, have on their back sides facing the plate elements 2 stop webs 11 to connect to the plate elements 2. This creates a solid joint between said edge profiles 8, thus lending them a dual function. On the one hand, they allow the rolling off of the edges 3 of the plate elements 2 relative to one another to arrange appropriate hinge parts at said location, while on the other hand, they enforce the entire plate element 2 like a frame. The surface form in the edge area is also pleasing and there is practically no detraction by the hinge elements 4 and 5 because the magnets 6 are developed as a plate and the pole shoes 9 are located in the cutting plane of the edge profile 8, with only narrow strips of the face of the pole shoes 9 being visible at the surface due to the coating 10 mentioned earlier.

As additional holding means for the plate elements 2, vertical members with feet (not shown) may be provided, which results in an especially favorable application area of said hinge joints for plates used as protection against view and/or noise. In this way, the hinge joint allows an advantageous individual and arbitrary assignment of said plate elements without requiring any expensive assembly with appropriate supports, holding profiles, etc. Furthermore, the plate elements can be moved arbitrarily into other positions by the user at any time. Fig. 1 and 2 show that two magnets 6, or if necessary more such magnets 6, can be inserted across the height of one hinge part 4, and that a ferromagnetic counterpart 7 can be inserted in the complementary hinge part 5 at the same level as the magnets 6. This lends said

hinge parts 4 and 5 greater stability than if only one magnet had been provided.

The figures 4 and 5 indicate that the hinge joint 1 in accordance with the invention also makes it feasible to hinge more than two plate elements 2 together. For example, three plate elements 2 can converge respectively at an edge 3, in which case it is useful if the magnets 6 are inserted in the curved hinge part 4 of a plate element 2, and counterparts 7 of a ferromagnetic material are inserted in the hinge parts of the other plate elements. Fig. 4 shows four abutting edges 3 of plate elements, with respectively alternating hinge parts 4 with magnets 6 and hinge parts 5 with ferromagnetic counterparts 7 being provided. It would also be feasible, however, to add two respective plate elements arranged in a rectangle to the hinge joint in accordance with Fig. 3, with said plate elements then requiring only ferromagnetic counterparts 7, and the magnets 6 of the one plate element holding all other plate elements in the hinge area.

Fig. 5 shows an arrangement of six plate elements 2 proceeding from one point, with hinge parts 4 and magnets 6 and hinge parts 5 and counterparts 7 again being alternately detachably connected to one another.

The hinge joint in accordance with the invention therefore not only allows the detachable and easily adaptable connection of two, but rather of a plurality of plate elements, which considerably increases the applicability and versatility. Nevertheless, great connecting strength is achieved despite the easy adaptability of the angle positions and the simple detachability of the hinge parts, and the upper sides of the hinge parts 4 and 5, which are important for the rolling off upon one another, are resistant to potential knocks or jolts because they can be largely coated with plastics material; for the hinge joint, only pole shoe faces projecting at a few narrow places are

important, which would be difficult to damage or impair even with improper handling. Delicate protruding parts that would have to engage in the connection are avoided.

All characteristics and structural details in the description, the claims, the abstract and the illustration may be of essential significance independently as well as in any combination.

- Claims -

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Hinge Joint

Claims

1. Hinge joint (1) for at least two plate elements (2) which are variable relative to one another in their angular positions, are detachable from one another and at the edges (3) thereof facing and abutting one another have at least one respective hinge part (4, 5), at least one of which is of convex curvature in cross-section, with the two said hinge parts (4, 5) being adapted to be rolled one upon another as they are swiveled relative to one another, and with the plate elements (2) preferably having at least one additional holding means in addition to the hinge joint (1), **characterized in that** the two hinge parts (4 and 5) are magnetically connected in the convex area.

2. Hinge joint in accordance with claim 1, characterized in that the plate elements (2), which preferably can be connected to one another across the entire length and/or height, have a plurality of hinges (1) with at least one

respective magnet (6), which are distributed across the height.

3. Hinge joint in accordance with claim 1 or 2, characterized in that one hinge part (4) has at least one magnet (6) and the associated complementary hinge part (5) has at least one counterpart (7) of magnetic or ferromagnetic material at the same height of the magnet(s).

4. Hinge joint in accordance with one of the claims 1 to 3, characterized in that the two hinge parts (4, 5) are comprised of metal profiles (8) having a convex rounded cross-section at the sides facing one another, preferably of a non-magnetic material, with a magnet (6) being inserted in an area of one of the hinge parts (4) and an opposing oppositely poled magnet or a part made of magnetic material (7) being located opposite said magnet.

5. Hinge joint in accordance with one of the claims 1 to 4, characterized in that the magnet (6) is developed as a plate and has pole shoes (9) on both sides, which are arranged in the cross-section planes of the edge profile (3).

6. Hinge joint in accordance with one of the claims 1 to 5, characterized in that the pole shoes protrude relative to the actual magnets (6) at the surface of the hinge parts (4) and that at least the upper side of the hinge parts is coated with the magnetic pole shoes, preferably with plastics or foamed material that ends flush with the protruding pole shoes (9).

7. Hinge joint in accordance with one of the claims 1 to 6, characterized in that the convex curvature of the hinge

parts (4, 5) has the shape of a circular arc in cross-section and reaches preferably approximately over a half-circle.

8. Hinge joint in accordance with one of the claims 1 to 7, characterized in that the edge profiles (8), which are curved outward and/or convex or have the shape of a circular arc relative to one another in cross-section, have on their sides facing the plate elements (2) stop webs (11) or the like to connect to the plate elements (2).

9. Hinge joint in accordance with one of the claims 1 to 8, characterized in that as additional holding means for the plate elements (2), the angle positions of which can be adapted by the hinge joint, vertical holders with feet are provided at said plate elements.

10. Hinge joint in accordance with one of the preceding claims, characterized in that distributed over the height of the hinge parts (4) that can be rolled off relative to one another, at least two or more magnets (6) are inserted at one of the hinge parts and a ferromagnetic counterpart (7) is inserted at the complementary hinge part (5) at the same height as the magnets (6).

11. Hinge joint in accordance with one of the preceding claims, characterized in that the magnets (6) inserted in a hinge part (4), which are preferably have the cross-section of a half-circle, are magnetized through.

12. Hinge joint having at least three plate elements (2) that can be adapted with respect to their angular positions and abut at one edge (3) in accordance with one of the claims 1 to 11, characterized in that magnets (6) are

inserted in the curved hinge part (4) of a plate element (2) and counterparts (7) of ferromagnetic material are inserted in the hinge parts of the other plate elements.

13. Hinge joint having at least four plate elements (2) that can be adapted with respect to their angular positions in accordance with one of the claims 1 to 12, characterized in that hinge parts (4) having magnets (6) and hinge parts (5) having ferromagnetic counterparts (7) are alternately detachably connected side-by-side.

14. Hinge joint in accordance with one of the aforementioned claims, characterized in that a plate element (2) has on its one vertical edge (3) at least one hinge part (4) with magnets and at its opposing parallel edge at least one complementary hinge part (5).

- Abstract -

- 4 - pages of figures

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EUROPEAN PARTIAL SEARCH REPORT,

Application Number **0178504**

RELEVANT LITERATURE			
	Identification of the document, stating the relevant parts, if required	Relates to claim	Classification of the application (Int. Cl.[4])
Y	FR-A-2 214 058 (FORMFAC INTERNATIONAL) * Fig. 1-3; claims 1-4; page 2, lines 2-40; page 3, lines 1-27 *	1-4, 7-9, 13	E 04 B 02/74 E 05 D 01/00
Y	DE-A-2 508 524 (PLANACORD GmbH & CO. KG) * claims 1,5; Fig. 1-6 *	1-4, 7-9, 13	
A	DE-A-1 929 907 (FA. K. SIMON) * claim 1; Fig. 1,2 *	5, 6, 11, 12	
A	US-A-3 592 289 (AYSTA et al.) * Figure 2 *	9	SUBJECT AREAS SEARCHED (Int. Cl.[4])
A	DE-A-1 553 540 (BAERMANN)		E 04 B E 05 D E 05 C
A	FR-A-2 218 865 (FA. J. HÜPPE)		

The present search report was prepared for the patent claims.

Place of Search	Completion date of search	Examiner
The Hague	19 Dec 1985	BOUSQUET K.C.E

CATEGORY OF THE STATED DOCUMENTS	
X: of special significance on its own Y: of special significance in connection with another publication in the same category A: technological background O: non-written publication P: intermediate literature T: theories and principles on which the invention is based	E: older patent document that was not published until or after the date of application D: document listed in the application L: document cited for other reasons &: member of the same patent family, conforming document